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Instructions for Installing digiBASE Plug-in on a Terra Harvest Controller

by Timothy C Gregory

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14. ABSTRACT

The Battlefield Information Processing Branch of the US Army Research Laboratory developed a Terra Harvest/Open Standards for Unattended Sensors (OSUS) plug-in to control an ORTEC NaI(Tl) Scintillation Detector with a digiBASE Universal Serial Bus (USB) Interface. This report describes the installation and configuration of the plug-in on a Terra Harvest controller.

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Terra Harvest controller, open standards for unattended sensors, OSUS, radiation detector, digiBase

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1. Introduction

The Battlefield Information Processing Branch of the US Army Research Laboratory developed a Terra Harvest/Open Standards for Unattended Sensors (OSUS) plug-in to control an ORTEC NaI(TI) Scintillation Detector with a digiBASE Universal Serial Bus (USB) Interface. This report describes the installation and configuration of the plug-in on a Terra Harvest controller.

A scintillation detector is an instrument for detecting gamma radiation. It consists of a scintillator and a photomultiplier tube (PMT). The scintillator generates photons of light in response to incident radiation. The PMT converts the light into electrical signals.

The ORTEC digiBASE provides the necessary power and signal processing requirements for a PMT. The ORTEC digiBASE interfaces with the computer through the USB.

The digiBASE plug-in is an asset for the Terra Harvest controller that provides the ability to detect gamma rays. It is required to operate within the Terra Harvest/OSUS software environment on a Linux operating system.

2. Objective

This report describes how to install the digiBASE asset plug-in on a Terra Harvest controller.

3. Installing the Asset Plug-In

The software for the digiBase asset is contained in a Java Archive (JAR) file. The asset plug-in can be installed through the Terra Harvest/OSUS Web graphical user interface (GUI) or by placing the JAR file directly into the bundle directory for the controller.

3.1 Installing Through the Web GUI

The asset plug-in may be installed using the Terra Harvest Web GUI. The JAR file is installed through the System Configurations page of the Web GUI. Press the Install/Update Bundle button on the Web GUI. Then browse to the desired JAR file and press the Install/Update button on the pop-up window as shown in Fig. 1. The installation is now complete. For details about the Web GUI refer to the Terra Harvest Operator Instructions.[1]

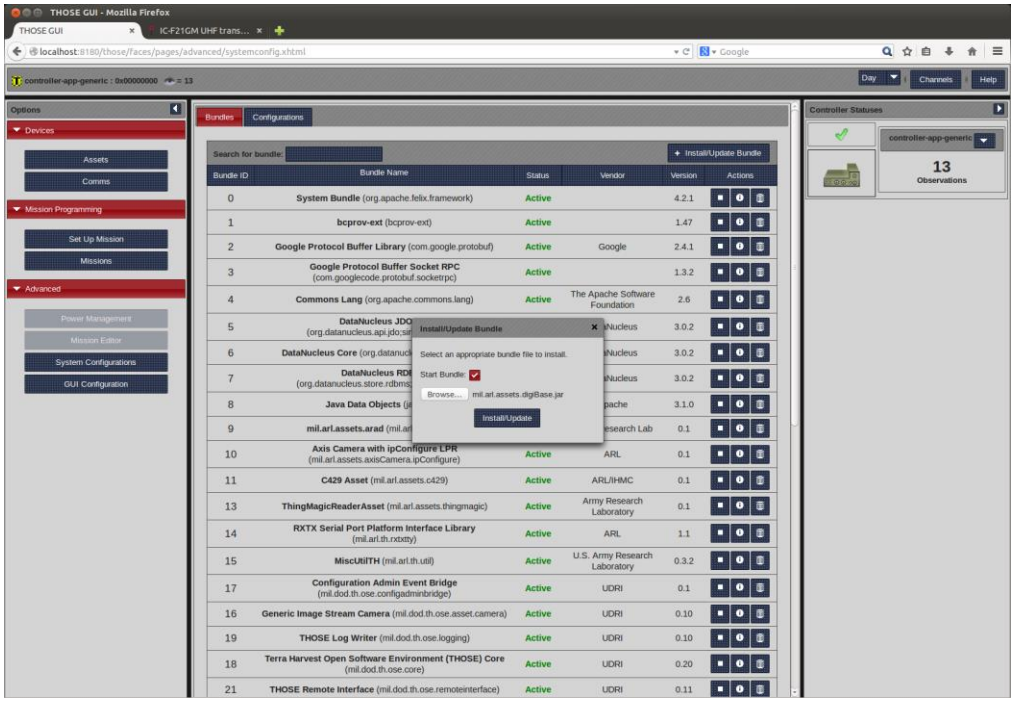

Fig. 1 System configurations page

3.2 Place JAR File in Bundle Directory

The JAR file can also be placed directly into the bundle directory. The path to the bundle directory is typically ~/controller/bundle.

If the JAR file is manually placed in the bundle directory, it will be necessary to restart the Terra Harvest controller. The digiBase asset must then be created on the Asset page of the Web GUI as described in the next section.

4. Create a digiBase Asset

A Terra Harvest asset is created on the Asset page of the Web GUI. The steps for adding an asset are shown below. Figure 2 shows the pop-up window for adding an asset.

1) Press the "Assets" button in the Options pane.
2) Press the "+ Add Asset" button.
3) Press the "Refresh" button to update the assets list.
4) Select the digiBaseAsset.
5) Enter an asset name in the asset name text box (i.e., digiBaseEast).

6) Press the Ok button.

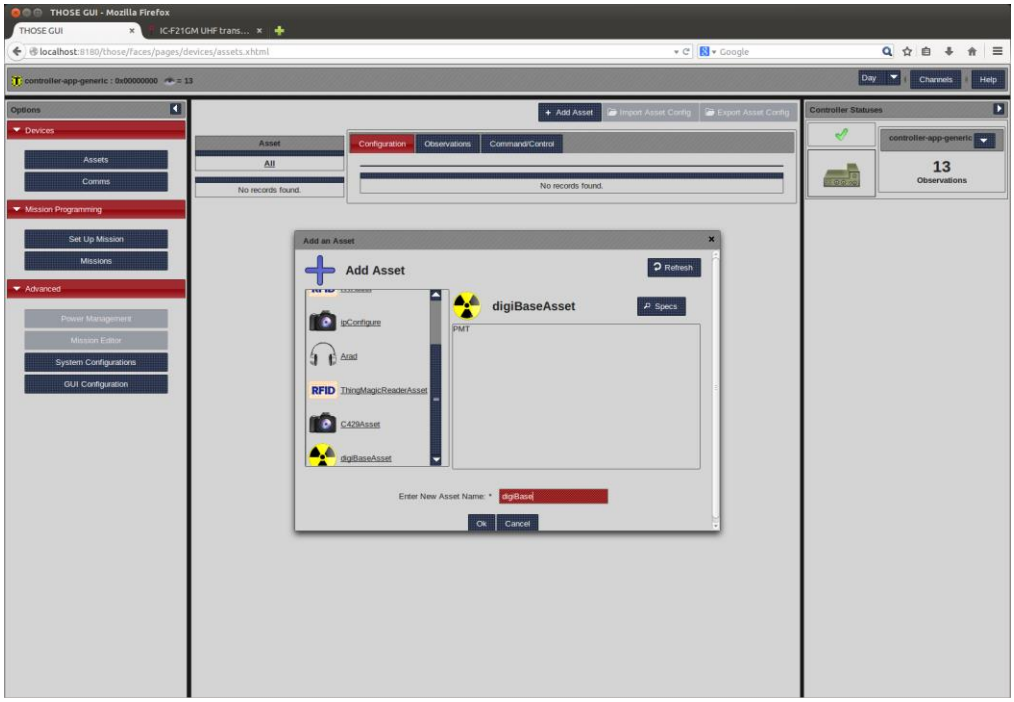

Fig. 2 Add an asset

The asset must now be activated by pressing the Activate button. Figure 3 shows the digiBase asset before it is activated.

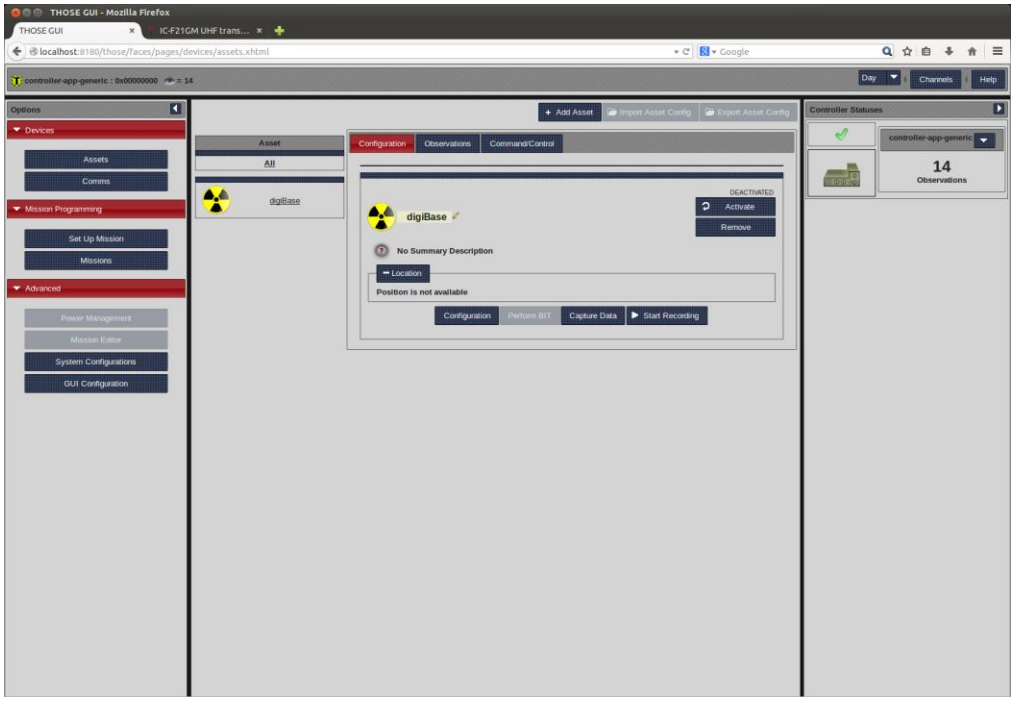

Fig. 3 digiBase asset

5. Configuration Parameters

There are several parameters that control asset operation. These are configured through the Terra Harvest GUI. Table 1 shows the various configuration parameters for the digiBase asset plug-in. Most of the configuration parameters can be left at the defaults. The operator may want to set the Activate on Startup parameter to True in order to automatically activate the digiBase asset on controller startup.

Table 1 Configuration parameters

Parameter	Type	Default Value	Description
Activate on Startup	Boolean	False	When True, the asset will be activated when Terra Harvest starts.
Use Plug-in Position	Boolean	False	This item is not implemented by the digiBase asset plug-in.
Alert Threshold	Float	3.0	If the sampled value is outside the "n" sigma, a detection is recorded.
Fine Gain	Float	1.19	The amplifier gain. Range is between 0.4 and 1.19 inclusive.
High Voltage	Float	850	The voltage applied to the PMT[a]. The range is between 0 and 1,200 volts.
Send Image of Graph	Boolean	True	If true, the plug-in will create and post an observation containing a graph of the spectrum
Send Binary Spectrum	Boolean	True	If true, the plug-in will create and post an observation containing the raw data for the spectrum
Live-Time Preset	Float	3.0	Sets the live time for the counter.
Real-Time Preset	Float	0.0	Sets the real time for the counter.
Clear Spectrum Between Samples	Boolean	True	When true, the spectrum in the digiBase will be cleared before each sample is started.
Sample Background at Interval (minutes)	Integer	60	Number of minutes between taking background samples.
How Many Samples to Take	Integer	20	The number of samples that will be averaged during a background measurement. These will be used to determine the average and standard deviation of the counts.

[a]Photomultiplier tube.

Table 1 Configuration parameters (continued)

Parameter	Type	Default Value	Description
Ignore First N Samples	Integer	2	The number of samples to ignore. This allows the PMT[a] to stabilize.
Latitude	Float	0.0	The latitude of the sensor's position.
Longitude	Float	0.0	The longitude of the sensor's position.
Altitude	Float	0.0	The altitude of the sensor's position.
Update Interval	Float	10	Number of minutes between status reports for the sensor.

[a]Photomultiplier tube.

6. Operation

6.1 Automatic Capture

Once the digiBase asset is activated, it will take a measurement of the background radiation spectrum to be used for comparison. The asset will take 20 spectrum measurement samples. For each sample, the total counts will be computed. Then the average and standard deviation will be computed for the 20 samples. These statistics will then be used to determine whether or not a future observation will be recorded as a detection. The asset will periodically update the background sample used for comparison since background radiation varies over time. The time between samples is specified by a configuration parameter namely "sample background at interval".

The asset will remain in a waiting mode, except for taking periodic background measurements, until the onStartRecording() method is called. Then it will start taking samples and comparing them to the most recent background measurement sample. If the total counts for a given sample are not within the n-sigma range, a detection/observation will be created and persisted.

If the "send image of graph" configuration parameter is set to true, the asset will create an image representing the spectrum. This image will be posted in an observation. Figure 4 shows a graph of the background radiation. The appendix contains a sample Extensible Markup Language (XML) representation of the observation containing the graph.

If the "send binary spectrum" parameter is set to True, the asset will encode the raw counts into a 1,024-byte array. The array of data is then posted in an observation. The appendix contains a sample XML representation of the observation containing the raw counts.

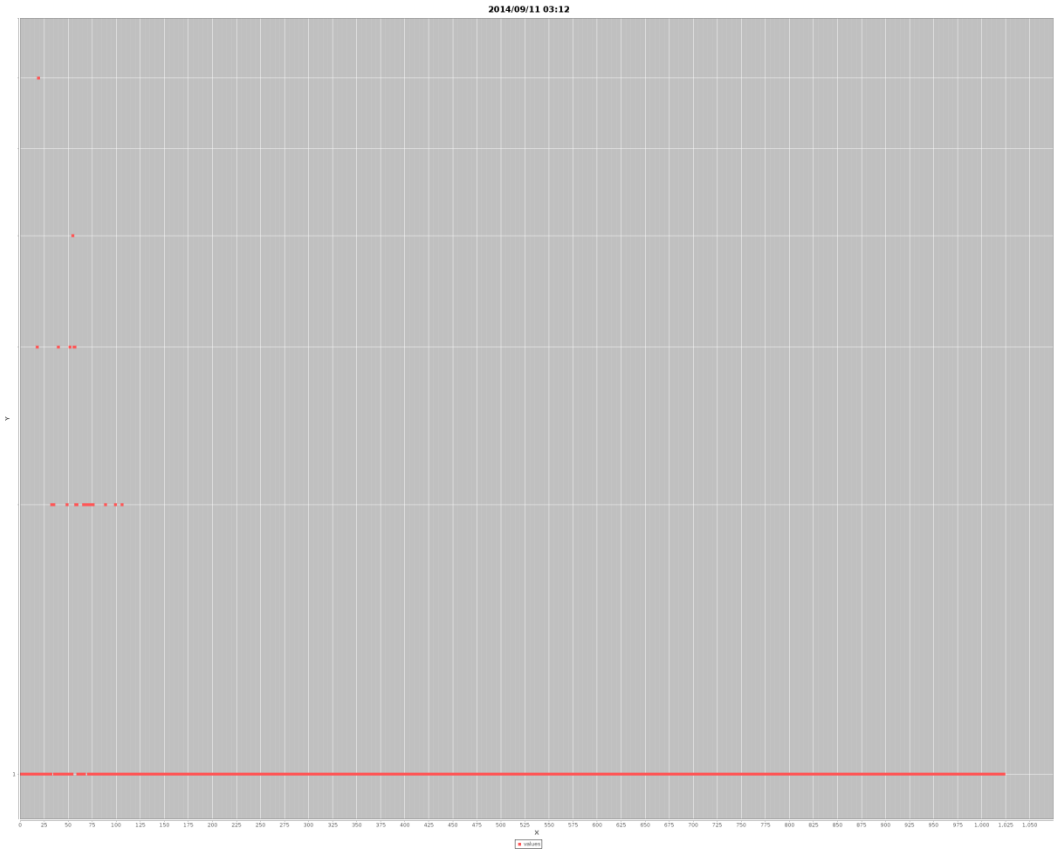

Fig. 4 Sample spectrum

6.2 Manual Capture

The operator can initiate a spectrum capture by pressing the "Capture Data" button for the asset. This will cause the digiBase asset to capture 1 spectrum and post an observation containing a graph of the spectrum. The configuration parameter "live time preset" is used to denote the length of time to record counts. Fig. shows a sample of a captured spectrum.

7. References

1. Operator Instructions for the Terra Harvest Open Source Environment (THOSE); University of Dayton; March 2014.

INTENTIONALLY LEFT BLANK.

Appendix. Sample Terra Harvest Observations

A-1 Sample Observation Containing Spectrum Graph

A sample of the Extensible Markup Language (XML) document containing the graph of a spectrum is shown below. The image of the graph is base 64 encoded.


```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Observation xmlns="http://th.dod.mil/core/observation/types"
xmlns:ns2="http://th.dod.mil/core/types/spatial"
xmlns:ns3="http://th.dod.mil/core/types" uuid="56800fd8-1e87-4d91-aacf-
1b757240c712" timestamp="2014-05-03T10:56:16.898Z" assetId="d1683304-
340a-45a9-8130-04d2d2a64c81" assetName="Dock-Ortec"
assetType="mil.arl.assets.digiBase.digiBaseAsset" systemInTestMode="true"
systemId="5104">
   <version>
      <majorNumber>2</majorNumber>
      <minorNumber>0</minorNumber>
   </version>
   <coordinates>
      <ns2:longitude>-76.64007</ns2:longitude>
      <ns2:latitude>37.27757</ns2:latitude>
      <ns2:altitude>10.0</ns2:altitude>
   </coordinates>
   <digitalMedia encoding="image/png">
iVBORw0KGgoAAAANSUhEUgAACgAAAAgACAIAAABlqf2mAACAAElE
QVR42uzdb6jdBR3H8dnZ2Th2Az
…
czMzMzMzFbk+1OPwMzMzMzMzAb/3akDsJmZmZmZmdmKfH/qEZiZmZmZ
mdngvzt1ADYzMzMzMzNbke9PPQIzMzMzMb/HenKebX0czMzMzAb/
LbZHYGZmZmZmZmZmZmZmaWY/8HSLV1hQwGGj4AAAAASUVORK
5CYII=
</digitalMedia>
   <imageMetadata captureTime="2014-05-03T10:56:05.606Z"
pictureType="FullFieldOfView" focus="1.0" zoom="1.0" color="true"
changedPixels="0.0" whiteBalance="Auto">
      <resolution width="2560" height="2048"/>
      <samplesOfInterest>
         <topLeft x="1" y="1"/>
         <bottomRight x="10" y="10"/>
         <directionOfTravel directionType="LR" description=""/>
      </samplesOfInterest>
      <imager imagerType="Other" description="digiBase"/>
      <imageCaptureReason imageCaptureReasonType="TargetDetection"
description="exceeded background"/>
   </imageMetadata>
</Observation>
```

A-2 Sample Observation Containing Raw Counts for Spectrum

A sample observation containing the raw counts for the spectrum is shown below. The image type is “image/spectrum”. The array is base 64 encoded. Note that the digitalMedia encoding attribute is set to “image/spectrum”.


```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<Observation xmlns="http://th.dod.mil/core/observation/types"
xmlns:ns2="http://th.dod.mil/core/types/spatial"
xmlns:ns3="http://th.dod.mil/core/types" uuid="83053f10-1c35-4253-96b4-
d640f617ab06" timestamp="2014-05-03T10:56:17.646Z" assetId="d1683304-
340a-45a9-8130-04d2d2a64c81" assetName="Dock-Ortec"
assetType="mil.arl.assets.digiBase.digiBaseAsset" systemInTestMode="true"
systemId="5104">
   <version>
      <majorNumber>2</majorNumber>
      <minorNumber>0</minorNumber>
   </version>
   <relatedObservations uuid="56800fd8-1e87-4d91-aacf-1b757240c712">
      <relationship>
         <relationshipType>parent</relationshipType>
      </relationship>
   </relatedObservations>
   <coordinates>
      <ns2:longitude>-76.64007</ns2:longitude>
      <ns2:latitude>37.27757</ns2:latitude>
      <ns2:altitude>10.0</ns2:altitude>
   </coordinates>
   <digitalMedia encoding="image/spectrum">
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAQAAAAAAAAAAAAAAAAAAAA
AAQAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAA…
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAEAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAg==</digitalMedia>
```

```
   <imageMetadata captureTime="2014-05-03T10:56:05.606Z"
pictureType="FullFieldOfView" focus="1.0" zoom="1.0" color="true"
changedPixels="0.0" whiteBalance="Auto">
      <resolution width="2560" height="2048"/>
      <samplesOfInterest>
         <topLeft x="1" y="1"/>
         <bottomRight x="10" y="10"/>
         <directionOfTravel directionType="LR" description=""/>
      </samplesOfInterest>
      <imager imagerType="Other" description="digiBase"/>
      <imageCaptureReason imageCaptureReasonType="TargetDetection"
description="exceeded background"/>
   </imageMetadata>
</Observation>
```

List of Symbols, Abbreviations, and Acronyms

GUI	graphical user interface
JAR	Java Archive
OSUS	Open Standards for Unattended Sensors
PMT	photomultiplier tube
USB	Universal Serial Bus
XML	Extensible Markup Language

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